Conservation of sediment in irrigation runoff

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CONTROLLING sediment entering natural streams in irrigation return flow is a major economic and ecological challenge. A landowner often has little control over the management practices of his upstream neighbors. But he may be able to use sediment from runoff draining onto his land to improve the land's topography. In so doing he may reduce erosion on his land and simultaneously lower the downstream sediment load.

Sediment carried in irrigation return flow usually is considered a pollutant, but small watersheds and drainage basins contain many areas where sediment can be removed from the water and used as an economical source of high quality topsoil for filling low areas and leveling land. Small fields can be combined to form larger, more economical farming units by filling gullies that divide them. Trapped sediment can also provide topsoil for landscaping. Sediment trapped near detachment sites for such uses is kept out of reservoirs, lakes, streams, and water conveyance systems where it might destroy aquatic habitats.

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An Idaho Study

The 202,000 acres served by the Twin Falls Canal Company in south central Idaho contain about 150 natural and man-made ponds that act as settling basins for irrigation runoff (Figure 1). This does not include very small ponds that catch runoff water from only one or two fields or ponds used for municipal sewage treatment or industrial waste disposal.

We estimated the number of ponds larger than one-half acre from survey data and classified them into three groups. About 14 ponds were used for water storage and sediment removal for pumpback or sprinkler irrigation systems. Another 42 natural and man-made ponds, located between row-ropped farmland and the canyon rim, served as settling basins for irri-

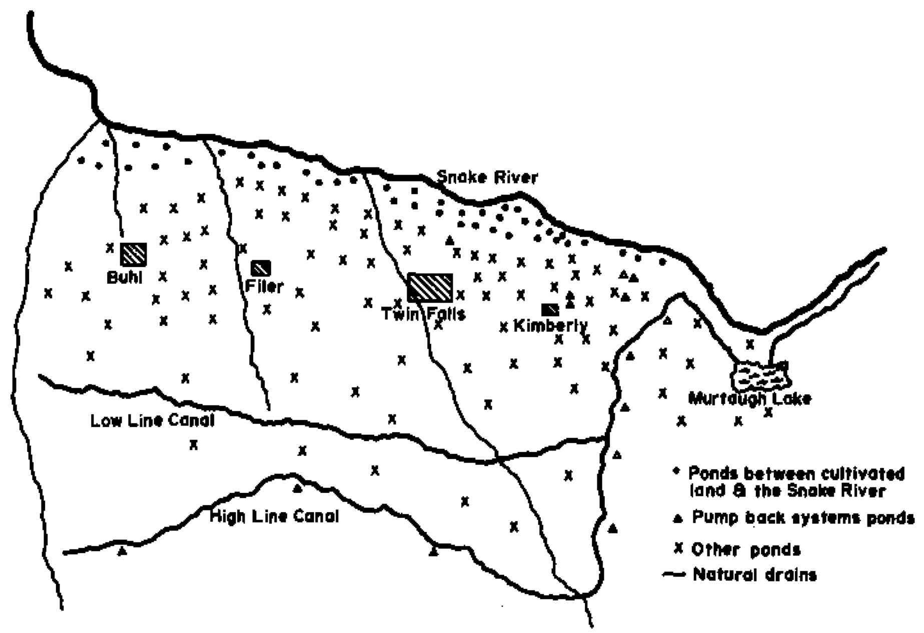

Figure 1. Approximate location and number of sediment ponds on the Twin Falls Irrigation Tract in south central Idaho.

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gation return flow re-entering the 500-foot deep Snake River Canyon. Water passing through these ponds did not cross cultivated land other than pasture and was not likely to pick up more sediment before it entered the river. An estimated 87 ponds were scattered throughout the more intensively row-cropped portion of the irrigation tract. These ponds, which catch sediment nearer the detachment source, were constructed for several reasons.

Some farmers constructed dikes across gullies to trap sediment for filling low areas, leveling land, and combining small fields into larger, more economical units. Fills built across natural gullies to support roads, railroads, or water conveyance systems provided ponds or ponding potentials when the culverts were so designed or altered. A few ponds were constructed to catch sediment to provide topsoil for landscaping around new buildings or for placement back on eroded fields.

On-farm ponds can trap considerable amounts of sediment and keep topsoil near the detachment source. In many cases, these practices can increase land values as much as $500 per acre.

The nearly 150 ponds in the irrigation tract varied from new ponds built after the 1973 irrigation season to ponds filled with sediment.

Determining Sediment Disposition

We determined water flow and sediment deposition in a 1.1-acre pond specifically constructed to trap sediment in a low area near an irrigation return drain. The natural drain catches irrigation runoff water from about 290 cultivated acres. The basin supplying water to the drain is intensively cropped to dry beans, sugarbeets, grain, alfalfa hay, and a limited amount of pasture. Highly erodible Portneuf silt loam covers the area. Slope varies from nearly 0 to about 15 percent. The sediment was used to fill a low area that was wet during the irrigation season because the drain ditch had been relocated along property boundaries at a higher elevation. A four-foot-wide dike was built along the two low sides, and water from the drain was diverted through the pond.

We determined trapped sediment volumes by surveying the newly constructed pond in April 1972 before water was diverted into it, in October 1972, and finally in July 1973 after ponding had been discontinued. With these volume figures and the bulk density of the deposited soil we calculated sediment weight. A trapezoidal flume and water stage recorded at the pond outlet measured the water discharge. We collected water samples during the irrigation season and determined the sediment load in both inflowing and outflowing water.

April 2, 1972

Fall 1972

July 10, 1973

Figure 2. Sediment pond at various stages of maturity. Note striped stakes in pond.

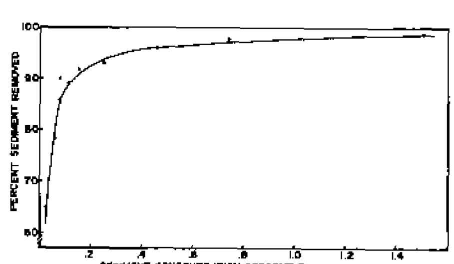

Figure 3. Sediment removed from irrigation runoff in relation to sediment concentration in runoff water.

Water was diverted into the pond on April 24, 1972 (Figure 2). By the fall of 1972 the pond was half full of sediment. It filled completely by July 5, 1973.

During 1972, 167 acre-feet of water passed through the pond depositing 1,254 tons of sediment. This was an average of 7.51 tons per acre-foot of runoff water or a yield of 8.4 acre-inches of topsoil (density of 1.3).

Between April 29, 1973, and July 8, 1973, 185 acre-feet of water passed through the pond depositing an additional 1,379 tons of sediment or 7.45 tons per acre-foot of runoff water. This amounted to 9.2 acre inches of topsoil in 1973.

The deepest point in the pond was raised 38 inches with an average increase in elevation for the entire pond of 16 inches. This elevation increase raised the level above the drain ditch and eliminated the swampy condition that existed previously.

The pond removed 85 percent of the sediment in runoff water when the sediment concentration exceeded 0.1 percent by weight (Figure 3).

In addition to the land improvement benefits, sediment removal from the drainage water during the ponding period reduced the sediment entering the water distribution systems and eventually the Snake River.

A Temporary Solution

Effective sediment ponds can be built in depressions or on shallow soil areas at minimum cost to a farmer if he uses his own equipment during slack work periods. The sedmient can be used to improve the land's topography and value. Despite these benefits, however, trapping sediment in man-made ponds must be considered a short-term or emergency measure. Solution of the sediment problem over the long term depends on effective conservation treatment at the sediment source. □